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ABSTRACT

This paper describes ways in which preservice students in an elementary education four-year degree program at the University of Regina (Saskatchewan) learn about and learn with information technology. Students learn specific skills and concepts related to informational technology (IT) and its uses and application to the classroom in specific ways at different stages of the program. Also discussed in the paper is the evolving faculty inservice training to reskill or retool instructors to enable them to provide meaningful IT experiences for students. One particular experiment is outlined, an experiment that addressed the content of and response to a specific set of five IT modules implemented in order to ensure that all students complete their education degrees with a mandatory set of technology concepts and skills, in a program where there is no mandatory computers in education class. Ways that students who have taken the five modules are using IT in pedagogically-appropriate ways are outlined. The paper also describes a vision of the IT future for faculty and students. (Author/AEF)

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Pedagogically Appropriate Integration of Informational Technology in an Elementary Preservice Teacher Education Program

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Abstract: This paper describes ways in which preservice students in an elementary education four-year degree program learn about and learn with informational technology. Students learn specific skills and concepts related to informational technology and its uses and application to the classroom in specific ways at different stages of the program. Also discussed in the paper is the evolving faculty inservice to reskill or retool our instructors to enable them to provide meaningful informational technology experiences for students. One particular experiment is outlined, an experiment that addresses the content of and response to a specific set of Informational Technology modules implemented in a Faculty of Education to ensure that ALL students complete their Education degree with a mandatory set of technology concepts and skills, in a faculty where there is no mandatory Computers in Education class. The paper also describes a vision of the IT future for our faculty and students.

Introduction

The authors work together in an elementary teacher education program. Vi teaches Mathematics Education, Nancy teaches Arts Education, and Liz teaches Education Professional Studies, a class focused on generic teaching methods and integration of all subject area classes. We strive to integrate technology in a natural and contextually-relevant manner into our specific curriculum areas. However, we know that the students need much more exposure to rich pedagogically-appropriate technological environments than we can possibly provide in our individual classes. Over the past five years we have worked through a variety of plans to ensure that students in the program become familiar with how to use technology effectively and appropriately in the classroom (see Maeers, Browne & Cooper, 1997).

This past year we developed a template which outlined all the IT concepts and skill areas that we felt students needed for teaching and the mandatory classes which offer some of these areas. There were many IT concepts and skill areas not accounted for in any of the classes. Attached to one of the classes (the Educational Professional Studies class) was a two-semester hour seminar, which was compulsory for all students in elementary education. Traditionally, this seminar focused on current educational issues and ideas. During the 1998-99 academic year we decided to introduce into this seminar some experimental informational technology modules, which will be described later in the paper. However, even this was not sufficient. In addition to what the students would receive in these modules, it was important that they saw IT modeled effectively in other classes. That meant that faculty who taught the elementary preservice teachers were encouraged to use (a) electronic presentation software in the delivery of some of their classes, (b) the internet and its resources as they were relevant to the content being worked with, (c) subject area software as it applied to the topic under discussion, and (d) e-mail communication as a natural way to communicate with students. These IT demands put tremendous pressure both on the faculty responsible for the IT modules and for all faculty to integrate IT into their classes.

Why Focus on Technology Integration?

In the above we have described the need to find opportunities in the program for the inclusion and integration of informational technology such that students learn about it and about how to use if effectively and appropriately in teaching. However, the question that arises is why--why are we trying to do this, why bother? Why not simply offer one Computer in Education elective class and have some of the students graduate with a solid IT skill and content knowledge base?

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Rationale for Decisions to Include IT for Every Elementary Preservice Teacher

We focus on technology integration and on helping our students create rich technological classroom environments for the following reasons:

1. Availability and currency of resources

There is a wealth of computer-related technology resources for all subject areas. Our preservice teachers need to know how to access these resources, how to evaluate them, how to discriminate the appropriate from the inappropriate, and how to integrate these resources effectively into curriculum-related classroom activity.

2. Employers of teachers want new teachers who are computer literate

Schools are acquiring more and more computers, many of them with internet capability. When hiring, school divisions are looking to new teacher graduates to provide in-school inservice for teachers, to teach children how to use the computer, and to lead schools, districts, and regions into the next millenium. Thus, there is tremendous pressure on faculties of education to create computer-literacy opportunities for graduating teachers. To be able to create and provide these opportunities, faculties of education need to be able to model effective use of technology in teaching.

3. The on-line provincial curriculum

The curricula for our province in Canada is now completely on-line for every subject for all grade levels. It is located at http://www.sasked.gov.sk.ca/docs/evergrn.html (Evergreen Curriculum). Additions and changes to curricula are currently made on-line. Hard copy curriculum guides will soon cease to exist or will exist only in the last printed version. It is important to know about the content of the provincial curricula, how that content is organized, how to search the data base, and about all the other resources that are available on-line for teachers; teachers need to be aware of all these resources, but so also do our preservice teachers who are now preparing lessons for practice teaching, and who will soon be seeking employment in the province.

4. Informational technology methods

Students could take IT workshops from a local college, or they could take a university computer science class, but neither of these would familiarize students with how to use technology for teaching. Certainly, students need to know IT skills, many of which can be learned through independent workshops. But where would students learn how to use computers in thoughtful ways, in pedagogically appropriate ways? Where would they learn how to evaluate programs and websites, where would they see modeled for them good teaching using technology, where would they learn how to integrate technology into their teaching and create rich technological environments where children could learn *with* technology?

Our students need to be critically aware of resources available through an electronic medium, they need to know about the demands of the field, both in hiring and in field expectations, and they need to know how to thoughtfully and appropriately use, and incorporate resources from, the Evergreen Curriculum into lessons and activities for classrooms. While we realize that our students need to know *about* technology and about *what* technology can provide, they also need to be able to *critically evaluate* and *discriminate* what (technological) resource to use, and whether one should be used at all. They need to be able to understand *conceptually and in pedagogically-appropriate ways*, how, where and why to use computer-related technologies.

Frameworks for Our Work

The programs within our Faculty of Education (Elementary, Secondary, Arts Education, Human Resource Development, Baccalauréat en éducation) are based on constructivist learning theory, on natural integration of subject areas, on a resource-based principle, and on active learning. This is particularly true in the Elementary Program, where the students are learning how to teach young children (Kindergarten through Grade 5 and Grades 6--9).

We could apply a number of learning theories and belief systems to our story of (experimental) institutional-technological change. Primarily, we are a faculty who work together to make change in caring, thoughtful ways, and who engage in collaborative endeavors, collaborative partnerships with other institutions, with the field, and collaborative research--usually with colleagues we work and teach with (Christiansen, Goulet, Krentz, & Maeers, 1996). Introducing the new into our program is, in our faculty, an

ongoing collaborative endeavor. Collaboration, to be successful, requires talking and listening, and generally engaging in dialogue or conversation. In a true conversation there is a topic, in our case the topic of meeting the challenge of ensuring that ALL students graduate with IT pedagogical competencies.

People engage in conversation around the topic to work out different strategies to solve the problem. No one person has the answer, no one person has the truth. If there is an answer or a truth it resides within the collaborative conversation. We benefit from each other's contributions. The students benefit from the final product of that conversation. In-depth conversation about a topic or challenge such as we faced takes a tremendous amount of time, time that takes us away from other work (e.g., writing for refereed journals--upon which promotion is judged). The manner in which we met the challenge of developing an IT inclusive teacher education evolved within an environment of sharing and caring, and of conversation as the vehicle of collaboration. This environment was itself an extension of a long story of invisible work (Kapuscinski, P., Browne, N., Krentz, C., Cooper, E., & Goulet, L., 1995) for institutional change.

The cognitive apprenticeship model of learning, described by Brown, Collins & Duguid (1989), which emerges from social constructivist theory (Ernest, 1991) forms a framework for our modules and the integration of technology into our teaching and learning. We assume that people work together and learn from each other, mentor each other, and grow together towards a final goal. Each person must learn for him or her self, no one can learn for another, and that learning best occurs with an environment of shared trust, where participants can experiment with their 'world', interact with each other and with the topic as they learn, and where personal knowledge emerges from testing the reality of their experimenting with the 'world' against the response they get from experimentation.

We also use a mathematical learning model applied to technological learning. This model, originally developed by Kieren and Pirie (1991), and later adapted by Maeers, Browne and Cooper (1997), demonstrates that each individual has a starting place of "Ethnotechnological Knowledge" (ET), a place defined by one's culture, previous experience with computers, and previous opportunities to become computer-literate. From an ET beginning learners' IT competency evolves through specific doing, through experimenting actively with rich computer-related experiences. In this stage "Concept Making" (CM), learners cannot yet make a plan of action for themselves, but are dependent on instructions and support. In the next stage "Concept Organization" (CO) learners can relate their CM activities, develop a mental image of where they're going, make a plan of action and execute it. CO activity is goal-directed, although the route taken to reach that goal may still be inefficient and haphazard. The next stage of the technological learning model is called "Analytic Processing" (AP). Here learners can evaluate and select appropriate tools, explain procedures and state why they made certain decisions. Here they can integrate technology into their lessons and work appropriately with technology in the classroom. The AP stage is really the beginning of pedagogically-appropriate activity and this is the stage we want our preservice teachers to reach. Beyond this stage, which we have not fully developed yet, one would find an experimental programming stage, a creative web design stage, and stages that we cannot yet imagine. In all of the above stages there is fluidity. When one reaches CO that does not mean that this stage has been attained for all IT concepts. Individuals move back and forth between the stages with each new area of IT learning. The most important stage, we feel, is the concept making stage; here is where students (and faculty) need multiple opportunities to interact with their computer world, with support, encouragement, models, and conversation. Preservice teachers need to work at the CM stage within an environment which is supportive of pedagogically-appropriate practice. Not only are the students learning how to use technology for themselves, they are learning how to use it for teaching and learning purposes.

Informational Technology Modules--an Experiment in Institutional Change

We decided as a program group, on an experimental basis, to take five seminar time slots from each semester and devote these seminars to informational technology topics. The following summarized topics were offered to students during the Fall 1998 semester:

Module #1:

- review of Eudora Mail
- sending messages, establishing distribution groups for discussion purposes
- discussion groups and individual report based on a recent three-day outdoor education experience

Module #2:

- exploration of the Evergreen Curriculum (Saskatchewan's on-line curriculum)

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- scavenger hunt on the curriculum

Module #3:

- demonstration of how to evaluate a site
- exploration of web-evaluation tools
- opportunity to evaluate a site

Module #4:

- using the web tools of Visual Page to create a personal website that can be stored on the Faculty of Education site
- creating the framework for a personal/professional portfolio

Module #5:

- exploring a WebQuest designed by faculty and discussing/evaluating the concept of a WebQuest in order to prepare for designing one next semester
- this WebQuest is called "Celebrating Nunavut" and can be found on the Faculty of Education home page at http://www.uregina.ca/educ

The Fall 1998 IT modules were skill-based and enabled students (and faculty) to acquire the IT skills and concepts necessary to use technology in pedagogically-appropriate ways. The series of IT modules planned for the Winter 1999 semester focuses more on how to integrate technology into the classroom learning environment. The hope is that the students would plan and implement these ideas in the field-based experience during the semester.

Faculty Inservice

In all new initiatives there is the need for training, for reskilling or retooling our instructors to assume roles of teaching about and teaching with technology, specifically with regard to the IT modules. As the content is to be integrated with other subject areas it was important that faculty understand the content and pedagogical implications of the above modules so that they could either teach the modules directly to their students, or assist in the teaching.

Vi was put in charge of organizing the content of the modules and for scheduling the seminar groups into computer lab time, hiring a senior student, and providing faculty inservice. We invited all the EPS faculty to attend the training sessions. They all came to all sessions--the first one was held on a Saturday morning. This training session was a non-example of efficient use of computer lab time. Everything went wrong. First of all, the faculty could not log on to their accounts in the computer lab because they couldn't recall their IDs and passwords. We had a two-hour work session planned and after 1 1/2 hours we were 15 minutes into the plan for the day. There were many frustrations and we were afraid that faculty would simply give up and walk out. But we laughed a lot, provided more coffee and cake, and got everyone over the obstacles of lab access, a very real experience for all of our students every year, and an experience that faculty are usually spared. We then experienced another obstacle: The Saskatchewan Education website which we were to visit that morning to explore the on-line curriculum, was down for upgrading. We couldn't reach it at all. Luckily, we had activities for module # 3 ready so we progressed to web evaluation. We debriefed this experience with the faculty group at the workshop and discussed how the unexpected often derails our plans, we modeled good problem solving strategies, patience, humor, and discussed how our experience that Saturday morning was a realistic flavor of "life in the lab." From an efficiency analysis perspective, our workshop might have been considered a disaster. By the end of the workshop, however, the faculty who attended were very appreciative of this "real-life" experience. People new to the world of IT learned from those a little more experienced; all faculty saw the seminar leaders (at least appearing) to be unperturbed by the obstacles, they saw us manage and problem solve the situation quite well, they saw how the experienced and the inexperienced could work side by side and learn from each other. Everyone asked questions and contributed to the conversation. In general, this workshop was considered a confidence-building situation.

During each faculty inservice we began with a short report from each instructor as to what occurred during the last IT module; did everything work well?; did the students understand the concepts and skills?; was the instructor able to teach what needed to be taught or what was his/her role?; what role did the senior student play?, and so on. Everyone was quite excited both about the level of learning from the students and

about their own personal learning. In addition to our regular meetings and training sessions we frequently met for hallway chats about the progress of everyone involved in the modules. The senior student was delighted with his learning about teaching adult students (his previous experience had been working with high school students). Through our almost continual conversation (both informally in the hall, and formally at program meetings, EPS meetings and our regular training session meetings) about the content and delivery of these five modules, we all felt very comfortable in our ability to offer them again next year, perhaps without the help of a senior student. At the time of writing this paper we are about to start our training sessions for the Winter 1999 modules and each faculty member has expressed the desire to assume more ownership of the content and leadership in the delivery. If we had tried to launch a series of workshops to train the faculty in IT issues we couldn't have hoped to be more successful. It is just possible, however, that some of our faculty would not be as interested in learning about the IT issues if teaching these issues was not imminent. It is sometimes in the learning how to teach it that we learn it--certainly with a deeper understanding.

It is evident that we cannot learn everything about technology, or about how to use technology in the classroom in five short modules each semester. However, if we can work with students and each other in a caring, friendly, collaborative manner, learning from them as we teach them, enabling them to learn using sound methods, good examples and allowing a lot of hands-on experimentation we may be able to get our students over the tough learning curve of learning about technology to learning how to use technology in caring thoughtful ways in the classroom.

Pedagogical Uses of Informational Technology in Teacher Education

The following are some of the ways that students who have taken the five modules in the Elementary Program are using IT in pedagogically-appropriate ways.

1. **E-mail**
   - discussion groups for discussing topics presented by the instructor, or ones which emerge from class readings
   - in-class distribution groups (mini listservs)
2. **The on-line curriculum**
   - using the on-line provincial curriculum for lesson/unit planning
   - searching the data base to find resources
   - support for all curriculum classes.
3. **WebQuests**
   - creating WebQuests based on the curriculum
   - a WebQuest incorporates the concept of cooperative groups and using the web as a research tool for curriculum-related purposes
4. **Software**
   - familiarization with subject-specific software and how to use this software appropriately in the creation of rich classroom learning environments.
5. **Website--electronic portfolio development**
   - personal and professional website development and the creation of electronic portfolios to present themselves to future employers
   - samples of lesson and unit plans can be posed on the site
   - WebQuests can also be posted

Our IT Future Vision

We can only imagine what will be possible a few years from now. Based on our current knowledge and computer hardware and software capabilities we have considered what we would like to do with IT in our program. Our goals can be framed by the following topics:

1. **Diversity and equity issues**
   - using e-mail to connect with people from other cultures who share common concerns

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- having e-pals or key-pals who would be considered experts in a specific area (e.g., child poverty) and conducting individual and group e-mail discussions with these people

2. **Continued curriculum support**
   - students should feel comfortable going to professionally-oriented sites, to on-line professional organizations, to on-line art galleries and evaluate, discriminate and integrate appropriate resources
3. **Continued (more sophisticated) WebQuest development**
   - the concept of a WebQuest will evolve and students can incorporate new WebQuest features into their creations
   - students can create multiple WebQuests and post them on their website
4. **Continued electronic portfolio development**
   - as webpage design tools become easier to use and more sophisticated so also will student webpage creations
   - the concept of an electronic portfolio to present yourself to the world (of hiring agencies) will evolve to include new features Ongoing faculty inservice
5. **WebCT course development**
   - some course, or parts of courses, can be developed using WebCT so that students who live many miles away can take the course on-line
6. **Faculty of Education homepage**
   - this homepage is quickly taking shape and will include sections for students to post their webpages and to post their WebQuests
   - there will also be program and subject area links and places for each subject area to present its courses and assignments

Summary

We're striving to move beyond the technical aspects of computers and to encourage our students to consider the integration of pedagogically-appropriate uses of technology. This is a real challenge for faculty members who completed their own formal education at least a decade ago. The experience of working with these new ideas has confirmed for us the importance of conversation as a means of effective institutional change. We are reminded again of the amount of work (intensive and often invisible) required for program change. At the same time we celebrate our own growth and enjoy observing the technological advances of our students. We are fortunate to work in a faculty where collaboration and change are the institutional norm.

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